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(12) United States Patent

Alderliesten et al.

(54) AIRCRAFT WING AND FIBER METAL LAMINATE FORMING PART OF SUCH AN AIRCRAFT WING

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(56) References Cited

U.S. PATENT DOCUMENTS

FOREIGN PATENT DOCUMENTS

EP 1614531 1/2006 GB 2151185 7/1985 (Continued)

OTHER PUBLICATIONS

International Search Report for PCTNL2001/050705 Mailed Nov. 30, 2011.

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(57) ABSTRACT

Fiber metal laminate (4) and an aircraft wing (1) having a longitudinal direction, comprising metal layers (5) and fiber reinforced plastic layers (6, 7, 6', 7'; 6", 7") in between said metal layers (5), wherein the metal layers (5) and the fiber reinforced plastic layers (6, 7, 6', 7'; 6", 7") are bonded together, and wherein the fibers of at least some of the fiber reinforced plastic layers (6, 7, 6', 7'; 6", 7") are arranged in a first group in a first plastic layer (6) and in a second group in a second plastic layer (7) whereby the fibers of the first group are at an angle with respect to the fibers of the second group, wherein said laminate (4) exhibits fibers of a first type and fibers of a second type, wherein the fibers of the first type being arranged in the said longitudinal direction of the laminate (4) in one or more of its fiber reinforced plastic layers (6', 7'; 6", 7"), and that it has adjacent fiber reinforced plastic layers (6, 7) at or near a symmetry-plane of the (Continued)

